U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: Elliptio spinosa (I. Lea.)

COMMON NAME: Altamaha spinymussel

LEAD REGION: 4

INFORMATION CURRENT AS OF: October 2005

STATUS/ACTION:

___ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status
___ New candidate
_X_ Continuing candidate
___ Non-petitioned
_X_ Petitioned - Date petition received: May 11, 2004
__ 90-day positive - FR date:
__ 12-month warranted but precluded - FR date:
__ Did the petition request a reclassification of a listed species?
FOR PETITIONED CANDIDATE SPECIES:
a. Is listing warranted (if yes, see summary of threats below)? _yes_
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? _yes_
c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions (including candidate species with lower LPNs). During the past 12 months, almost our entire national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations, and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (http://endangered.fws.gov/).
_X_ Listing priority change
Former LP: _5_

New LP: 2

Date when the species first became a Candidate (as currently defined): June 13, 2002

___ Candidate removal: Former LP:

___ A - Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F - Range is no longer a U.S. territory.

___ I - Insufficient information exists on biological vulnerability and threats to support listing.

___ M - Taxon mistakenly included in past notice of review.

___ N - Taxon may not meet the Act's definition of "species."

___ X - Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Clams -- Mollusca -- *Unionidae*

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Georgia

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Georgia

LAND OWNERSHIP: Approximately one-third of the Altamaha River floodplain is under State ownership and two-thirds is owned by private individuals and forest product industries. The State of Georgia manages several Wildlife Management Areas (WMA) along the river; however, some of this acreage is leased to the State by forest industries and is heavily logged. The following is a breakdown of ownership patterns in the floodplain of the Altamaha River: 1) private (41,613 acres (1845 hectares) or 34 percent); 2) forest industry (40,512 acres (8204 hectares) or 33 percent); 3) State (33,684 acres or 27 percent); 4) subdivision (2,848 acres or 2 percent); 5) non-forest industry (1,271 (508 hectares) acres or 1 percent); 6) The Nature Conservancy (TNC) (1,105 (442 hectares) acres or approximately 1 percent); 7) county (59 acres (24 hectares) or approximately 1 percent); and 8) other/unknown (24 (10 hectares) acres or approximately 1 percent). Detailed land use information for the Oconee and Ocmulgee rivers is not currently known.

LEAD REGION CONTACT: Rick Gooch, 404/679-7124.

LEAD FIELD OFFICE CONTACT: James Rickard, Athens, Georgia Field Office, 706/613-9493, extension 23

BIOLOGICAL INFORMATION:

Species Description

The Altamaha spinymussel (Elliptio spinosa) is a freshwater mussel endemic to the Altamaha River drainage of southeastern Georgia (Johnson 1970). It was described from the Altamaha River from a site near its mouth at Darien in 1836. The Altamaha spinymussel is medium to large in size, reaching a shell length of approximately 110 millimeters (4.3 inches). The shell is subrhomboidal or subtriangular in outline and moderately inflated. In young specimens, the outside layer or covering of the shell (periostracum) is greenish-yellow with faint greenish rays, but as the animals get older, they typically become a deep brown. Some raying may still be evident in older individuals. The interior layer of the shell (nacre) is pink or purplish. As the name implies, the shells of these animals are adorned with one to five prominent spines. These spines may by straight or crooked, reach lengths from 10 to 25 mm (0.39 to 0.98 in), and are arranged in a single row that is somewhat parallel to the posterior ridge (Johnson 1970).

Habitat

The Altamaha spinymussel is associated with stable, coarse to fine sandy sediments of sandbars, sloughs, and mid-channel islands and appears to be restricted to swiftly flowing water (Sickel 1980). Johnson (1970) reported that Altamaha spinymussels are found buried approximately 51 mm to 102 mm (2 to 4 in) below the substrate surface. Adult freshwater mussels are filter-feeders, siphoning phytoplankton, diatoms, and other microorganisms from the water column. For their first several months juvenile mussels employ foot (pedal) feeding and are thus suspension feeders that feed on algae and detritus. As a group, mussels are extremely long-lived, living from a few decades to a maximum of approximately 100 years. Large, heavy-shelled riverine species tend to have longer life spans. No age specific information is available for the Altamaha spinymussel. However, considering that it is a fairly large, heavy-shelled riverine species, it would seem probable that it is relatively long-lived.

Most mussels, including the Altamaha spinymussel, have separate sexes. Males expel sperm into the water column, which are drawn in by females through their incurrent apertures. Fertilization takes place internally, and the resulting zygotes develop into specialized larvae termed glochidia inside the water tubes of her gills. Glochidia must come into contact with a specific host fish(es) and parasitize that fish for a short time in order for their survival to be ensured. Efforts to identify the host-fish of the Altamaha spinymussel have thus far been unsuccessful. Without the proper host fish, the glochidia will perish. After a few weeks parasitizing the host fishes gill/fin tissues, newly-metamorphosed juveniles drop off to begin a free-living existence on the stream bottom. Unless they drop off in suitable habitat, they will die. Thus, the complex life history of the Altamaha spinymussel and other mussels has many weak links that may prevent successful reproduction and/or recruitment of juveniles to existing populations.

Historical Range/Distribution

The historical range of the Altamaha spinymussel was restricted to the Coastal Plain portion of the Altamaha River and the lower portions of its three major tributaries, the Ohoopee, Ocmulgee,

and Oconee Rivers (Johnson 1970; Eugene P. Keferl, Bruswick Junior College, pers. comm. 2001). The Altamaha River is formed by the confluence of the Ocmulgee and Oconee rivers and lies entirely within the State of Georgia. Since its description, the Altamaha spinymussel has been sought by many collectors and is found in numerous public and private collections. However, large scale targeted surveys for the mussel have been conducted only since the 1970's (Keferl 1994). Recent surveys have revealed a dramatic decline in the number of populations and number of individuals within populations throughout the species' historical range.

Current Range/Distribution

Ohoopee River

In a survey of the Ohoopee River, Keferl (1981) found the Altamaha spinymussel in thinly scattered beds in the lower five miles of the river, and live specimens were found at seven of eight collection sites there. By the early 1990's, however, only two live specimens were found at the same sites in the lower Ohoopee River (Keferl 1993). Stringfellow and Gagnon (2001) re-surveyed these sites using techniques similar to those used by Keferl (1981), but they did not find any live Altamaha spinymussels in the Ohoopee River. Therefore, it is either extirpated from the system or present in such low numbers that it is undetectable. Ironically, Keferl (1981) initially considered the Ohoopee River to be a possible refugium for the Altamaha spinymussel and other endemic Altamaha River mussel species.

Ocmulgee River

The Altamaha spinymussel is known from Coastal Plain portions of the Ocmulgee River from its confluence with the Oconee River upstream to Wilcox Co. Dr. Grace Thomas documented the farthest known upstream location at Red Bluff in the early 1960's. (Thomas and Scott 1965). 1965). The lower Ocmulgee River was surveyed by Keferl in the mid 1990's, by Georgia Department of Natural Resources personnel in 2000-2001 (Skelton et. al. 2002), by Christine O'Brien in 2001 (O'Brien 2002), and by Gerald Dinkins in 2004 (Dinkins 2004). Over 90 sites have been surveyed since 1993; many of which were surveyed repeatedly. Live Altamaha spinymussels have been detected at ten of these sites, which are distributed from Jacksonville downstream to the Oconee River confluence.

There is anectdotal evidence that Altmaha spinymussel formerly exhibited larger populations in the Ocmulgee River. Dr. Grace Thomas and colleagues collected 19 and 21 live individuals, respectively, during 2 surveys at Red Bluff. Dr. David Stansbery, of Ohio State University, made a collection of 11 live individuals from the Ocmulgee River at the U.S. Highway 441 bridge near Jacksonville in 1986. However, in their 2001 surveys, GDNR personnel found no live Altamaha spinymussels at Red Bluff or at the U.S. Highway 441 bridge (Skelton et al. 2002). They did, however, find three Altamaha spinymussels approximately one mile upstream of the U.S. Highway 441 bridge.

Similarly, early collecting efforts in the Ocmulgee River near Lumber City yielded many live

Altamaha spinymussels. Herb Athearn, of the Museum of Fluviatile Mollusks in Cleveland, Tennessee, made a single collection of 40 live spinymussels downstream of U.S. Highway 341 near Lumber City in 1962. In the 2001 GDNR surveys, eight surveyors found only six live Altamaha spinymussels during 2 separate surveys conducted at a sandbar in the same general area. All totaled, only 19 live spinymussels have been collected in the entire Ocmulgee River since 1993.

A new survey conducted by The Nature Concervancy searched the lower Ocmulgee for Altamaha spinymussels and arc mussels in 2004 (Dinkins 2004). Dinkins (2004) spent 29 man hours searching 25 sites that had previously been surveyed by O'Brien (2002). More than 1400 mussels were located during this survey, including 24 Altamaha arc mussels, however, no Altamaha spinymussels were found.

Oconee River

There are few historical records of Altamaha spinymussels from the Oconee River. Johnson (1970) lists one site in Montgomery Co. near Glenwood. The species has not been collected there since the late 1960's, and it is probably extirpated from the Oconee River system (E. Keferl, pers. comm., 2001). Compared to the other portions of its range, the Oconee River has not been extensively surveyed. As part of a dam re-licensing study, fourty-one sites between Lake Sinclair and Dublin were surveyed during 1995 (EA Engineering,1995). One hundred fourty-four hours of search time yielded only 118 live mussels representing 7 species; no Altamaha spinymussels were collected. Only about 10 sites downstream of Dublin have been surveyed since 1993. Although many of these sites had few or no live mussels, additional surveys are needed in the lower Oconee River.

Altamaha River

Most surveys for Altamaha spinymussels have been conducted in the Altamaha River. During 1993-1996, Gene Keferl surveyed 164 sites on the mainstem of the Altamaha River between the Ocmulgee-Oconee River confluence and the Interstate 95 crossing near the river's mouth. A total of 63 live Altamaha spinymussels were collected from 18 of these sites. These 18 sites were located between the Oconee River and Doctortown, suggesting absence or extreme rarity in the reach between Doctortown and the river's mouth (approx. 50 Km). In addition, ten of these sites were clustered within a 4 km reach upstream of the US 301 crossing near Jesup; the remaining sites were isolated by long distances of habitat with no or sub-detectable numbers of live spinymussels. Christine O'Brien (2002) surveyed 35 sites on the Altamaha River from the confluence of the Ocmulgee and Oconee Rivers downstream to Doctortown during 2001; these sites included all 18 of the known Altamaha spinymussel sites within the reach. She collected a total of six live individuals from 5 different sites and fresh dead shells from two additional sites. Twenty-five sites were were surveyed to collect specimens for host-fish trials during 2003 and 2004 (Brett Albanese, pers. Comm.). Live Altamaha spinymussels were only detected at 4 sites. Five of seven of the sites documeneted by O'Brien and all four sites documented during the host-fish surveys were clustered within a short reach of the Altamaha River just upstream of the US

301 crossing near Jesup.

Although methodological differences preclude accurate comparison of mussel abundances over time, there is evidence for historically higher abundances of Altamaha spinymussels in the Altamaha River. Jim Sickel sampled 7 sites downstream of the US 1 bridge in 1967. Sixty individuals were collected in one 500 m^2 site and an additional 21 individuals were collected in a second, 400 m^2 site. Two sites had five live mussels, two sites had one each, and two sites had no Altamaha spinymussels. Early surveys at the U.S. Highway 301 crossing documented 20 individuals in 1963, seven in 1965, and 43 in 1970. In contrast, the largest number of Altamaha spinymussels observed from a single site on the Altamaha River during the 1990's or 2000s was nine (Brett Albanese, Pers. Comm.)

Population Estimates/Status

Wisniewski et al. (2004) assessed the conservation status of endemic Altamaha basin mussels. With the exception of Stringfellow and Gagnon's (2001) survey of the Ohoopee River, their database included records from all of the major mussel distribution surveys conducted within the range of the Altamaha spinymussel since 1990 (e.g., all of Gene Keferl's post-1990 data, O'Brien 2002, Skelton et al. 2002, etc.), along with other historic records dating back to 1967. Live Altamaha spinymussels were detected at 24 of 241 sites (10%) sampled before 2000 and at 14 of 120 sites (12%) sampled after 2000. Although the percentage of sites occupied is not indicative of a decline, it should be noted that all of the surveys conducted after 2000 specifically targeted sites or reaches with historic records of the Altamaha spinymussel. Wisniewski et al. (2004) also conducted a test for a temporal change in sites occupied in the Ocmulgee and Altamaha Rivers between the early 1990's and the early 2000s. The Altamaha spinymussel was initially present in 13 of 39 sites that were sampled during both time periods. It was detected at 3 additional sites in surveys conducted after 2000 (i.e., presumed colonization events), but it was not detected at 11 of the initial 13 sites (i.e., presumed extirpation events). This test is imprecise because the failure to detect Altamaha spinymussels when present could result in both false colonizations (i.e, species missed during early surveys but detected in recent survey) and false extirpations (i.e., species detected during early survey but missed during recent survey). Thus, although the exact number of extinctions and colonizations between the two time periods may not be accurate, the much higher number of extinctions is suggestive of a decline over this time period.

Overall, the Altamaha spinymussel is critically imperiled. It has only been observed at 15 sites since 2000, despite extensive survey efforts made by several different researchers. Most of these sites are clustered geographically within short reaches of the lower Ocmulgee River and the Altamaha River upstream of Rt. 301 and there are long reaches with no or sub-detectable numbers of Altamaha spinymussels separating these groups of sites. Keferl's failure to detect Altamaha spinymussels downstream of Doctortown during the early 1990's suggests contraction from its historical range. Recent surveys of the Ohoopee River and the analysis presented by Wisniewski et al. (2004) suggest that the species may still be declining. Finally, the comparitively low numbers of Altamaha spinymussels collected during recent surveys of the Altamaha and Ocmulgee Rivers further suggests that this species has declined from historical

levels. To put these results in perspective, researchers in the 1960's were able to find more Altamaha spinymussels at a single site than researchers in the early 2000's were able to document in more than 386 hours of searching (Jason Winiewski, Pers. Comm.).

While the weight of evidence suggests the Altamaha spinymussel has declined from historic levels and may still be declining, there is a very strong need for the development of a statistically rigorous long-term monitoring program for Altamaha basin mussels. Differences in sampling methods, sampling effort, and overall sampling design make it difficult to compare results of surveys carried out by different researchers. There is also no information on the probability of detecting an Altamaha spinymussel during surveys, making it difficult to interpret absence data. Finally, while the differences in the number of Altamaha spinymussels observed during recent versus historic surveys are alarming, the methods used cannot equate these numbers to estimates of mussel density or population size. Funded by a State Wildlife Grant, the Georgia Dept. of Natural Resources is working with Dr. Jim Peterson and Jason Meador of the University of Georgia to develop a long-term monitoring program for Altamaha basin mussels.

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range. Altamaha spinymussels face severe habitat degradation from a number of sources. Primary among these are threats from sedimentation and contaminants within the streams that the Altamaha spinymussel inhabits. These threats to the Altamaha spinymussel are further compounded by its limited distribution and the low populations sizes identified in recent survey efforts.

Sedimentation, including siltation from surface runoff, has been implicated as the primary factor in water quality impairment in the United States (Neves et al. 1997) and has contributed to the decline of mussel populations in streams throughout the country (Ellis 1931, 1936; Imlay 1972; Coon et al. 1977; Marking and Bills 1979; Wilber 1983; Dennis 1985; Aldridge et al. 1987; Schuster et al. 1989; Wolcott and Neves 1991; Houp 1993; Richter et al. 1997). Specific impacts on mussels from sediments include reduced feeding and respiratory efficiency, disrupted metabolic processes, reduced growth rates, increased substrata instability, and the physical smothering of mussels (Ellis 1936; Stansbery 1971; Markings and Bills 1979; Kat 1982; Aldridge et al. 1987; Hartfield and Hartfield 1996, Brim Box and Mossa 1999). In addition, sediment can eliminate or reduce the recruitment of juvenile mussels (Negus 1966; Brim Box and Mossa 1999), act as a vector in delivering contaminants to streams (Salomons et al. 1987), and interfere with feeding activity (Dennis 1984).

Sickel (1980) characterized the habitat of the Altamaha spinymussel as coarse to fine grain sandbars, and suggested that this may make the Altamaha spinymussel susceptible to adverse effects from sediment (i.e., siltation). Sediments deposited on the stable sandbars required by the Altamaha spinymussel could make sandbars unstable, suffocate Altamaha spinymussels, or simply change the texture of the substrate. These alterations to the sandbars make them unsuitable for the species. There are numerous potential sources of sediment within the Altamaha River basin including unpaved roads, kaolin mines, and agriculture, silviculture, and

construction sites.

Many southeastern streams have increased turbidity levels due to siltation (van der Schalie 1938). Some mussels attract host fishes with visual cues, luring fish into perceiving that their glochidia are prey items. This reproductive strategy depends on clear water during the time of the year when mussels are releasing their glochidia (Hartfield and Hartfield 1996). Therefore, since turbidity is a limiting factor that impedes the ability of sight-feeding fishes to forage (Burkhead and Jenkins 1991), turbidity within the Altamaha River basin during the times that Altamaha spinymussels attempt to attract host fishes may have contributed and may continue to contribute to the decline of the spinymussel by reducing its efficiency at attracting the fish hosts necessary for reproduction.

Industrial forest management is practiced on approximately 40,000 acres (8000 hectares) or 33 percent of the floodplain of the Altamaha River (Lambert 2001). Although land use studies are not available for the remainder of the Altamaha River basin, large portions of the basin are under forest management. Typical forest management regimes in the Altamaha River basin use timber harvest methods and conduct other activities that result in ground disturbances. These ground disturbances can result in transport of sediment to streams during and after precipitation events. In addition to the sediment that is produced by ground-disturbing timber harvesting activities, forest management operations often require miles of unpaved roads to extract timber and to provide access for management activities. These roads, in conjunction with existing unpaved county roads that are prevalent throughout the Altamaha River basin, may also contribute significantly to sediment loading in streams after precipitation events. In addition, a number of kaolin mines are located along the Fall Line within the Oconee and Ocmulgee river basins. The operation of these mines and their supporting infrastructure has the potential to increase downstream sediment loads if adequate erosion control measures are not maintained to stabilize areas subjected to mining-associated ground disturbances.

The operations of the Edwin I. Hatch Nuclear Power Plant (Plant Hatch), located on the Altamaha River in Appling County, could pose a threat to the Altamaha spinymussel. In a letter dated November 27, 2001, regarding the relicensing of Plant Hatch, we expressed concerns about potential adverse impacts to aquatic fauna through entrainment of potential host fishes and thermal discharges and concluded that Plant Hatch had not adequately studied these potential impacts. Thermal discharges could negatively impact the Altamaha spinymussel from heat stress, algal blooms, and oxygen depletion in the Altamaha River. These effects would be exacerbated during years of low rainfall, when less water would be available to dissipate the heat of the Plant Hatch effluent. Each of these effects, if severe, could result in increased Altamaha spinymussel mortality downstream of Plant Hatch.

The expansion of operations at Plant Hatch is another potential threat to the Altamaha spinymussel in this reach of the Altamaha River. On September 14, 2001, the Service received Joint Public Notice 940003873 from the U.S. Army Corps of Engineers, Savannah District, describing a project to expand Plant Hatch's intake basin within the Altamaha River. Implementation of this permit would re-authorize maintenance dredging of the plant intake basin

and would authorize an L shaped dredged area that extends 900 feet parallel to the bank and 388 feet channel ward. This project will more than double the size of the intake basin and will dredge 44,424 cubic yards of material biannually from the intake basin. This dredging could negatively impact the Altamaha spinymussel by decreasing channel stability, altering sediment transport dynamics, increasing sedimentation and turbidity downstream during dredging operations, and by decreasing habitat quality for host fishes. It is unknown how far downstream these impacts would extend.

Contaminants entering the Altamaha River basin are another factor that may negatively impact the Altamaha spinymussel. In laboratory experiments, mussels suffered mortality when exposed to 2.0 ppm cadmium, 5.0 ppm ammonia, 12.4 ppm chromium, 16 ppm arsenic trioxide, 19 ppm copper, and 66 ppm zinc (Mellinger 1972; Havlik and Marking 1987). However, effects depend upon the length of exposure and mussel life stage. Contaminants contained in point and non-point discharges can degrade water and substrate quality and adversely impact, if not destroy, mussel populations (Horne and McIntosh 1979, McCann and Neves 1992, Havlik and Marking 1987). The effects of various contaminants on mussels were reviewed by Havlik and Marking (1987), Naimo (1995), and Keller and Lydy (1997), however, no toxicity studies have been done on the Altamaha spinymussel. Furthermore, differences between laboratory and field conditions make it difficult to predict how contaminants affect wild populations (Jason Wisniewski, Pers. Comm).

Mussels appear to be among the most intolerant organisms to heavy metals (Keller and Zam 1991), and several heavy metals are lethal, even at relatively low levels (Havlik and Marking 1987). Most metals are persistent in the environment (Miettinen 1977), remaining available for uptake, transportation, and transformation by organisms for long periods (Hoover 1978). Metals stored in the tissues of freshwater mussels indicate recent or current exposure, while concentrations in shell material indicate past exposure (Imlay 1982, Havlik and Marking 1987). Highly acidic pollutants, such as metals, are capable of contributing to mortality by dissolving mussel shells (Stansbery 1995).

Numerous municipal wastewater treatment plants discharge large quantities of effluent into the Altamaha River or its tributaries. For example Bibb County, Georgia, which includes the City of Macon, was permitted to discharge 39.70 million gallons per day (MGD) of domestic waste water into the Ocmulgee River in 1990 (Marella and Fanning 1990). The cumulative effects of this effluent on Altamaha spinymussel habitat have not been quantified.

Contaminants associated with industrial and municipal effluents (e.g., heavy metals, ammonia, chlorine, numerous organic compounds) may cause decreased oxygen, increased acidity, and other water chemistry changes that may be lethal to mussels, particularly the highly sensitive early life stages of mussels (Rand and Petrocelli 1985, Sheehan et al. 1989, Keller and Zam 1991, Dimock and Wright 1993, Goudreau et al. 1993, Jacobson et al. 1993, Keller 1993). The adults of certain species may tolerate short-term exposure (Keller 1993), but low levels of some metals may inhibit glochidial attachment in some species (Huebner and Pynnönen 1992). Mussel recruitment may be reduced in habitats with low but chronic heavy metal and other

toxicant inputs (Yeager et al. 1994, Naimo 1995, Ahlstedt and Tuberville 1997). Although effluent quality has improved with modern treatment technologies and a ban on phosphate detergents, municipal treatment plants were permitted in 1990 to discharge more than 43 MGD of waste water into the Altamaha River basin below the Fall Line, a geologic land form that separates the Piedmont and Coast Plain physiographic provinces (Marella and Fanning 1990). These discharges are likely to increase as human populations increase, which is expected to have negative long-term effects on the Altamaha spinymussel if contaminant levels within the discharges are not controlled.

There are a number of recent illegal effluent discharges into the Altamaha River basin that could have impacted the Altamaha spinymussel. For instance, the wastewater treatment discharge from Reidsville State Prison enters the Ohoopee River approximately six miles upstream of the largest historical population of Altamaha spinymussels known in the Ohoopee River. The Altamaha Riverkeeper, a watchdog group that works to maintain the quality of the Altamaha River system, reports discharge violations, and sues the violators in court, reported fecal coli form discharges from the prison that exceeded the prison's National Pollutant Discharge Elimination System (NPDES) permit. In addition, the Altamaha Riverkeeper has recently won three court cases for violations of NPDES permits in the Altamaha River basin. In the first, it won a summary judgment against Amercord Inc. for numerous violations of Amercord's NPDES permit at its Lumber City tire plant for discharges into the Ocmulgee River. In this case, Amercord was alleged to discharge quantities of cyanide, copper, zinc and lead in excess of its NPDES permit, and Amercord did not dispute the allegations. The second case was regarding alleged discharges into the Ocmulgee River from Lumber City's waste treatment pond in excess of Lumber City's NPDES permit. The Altamaha Riverkeeper won the case, and Lumber City agreed to implement several short term and long term waste water treatment improvements, which are expected to protect a population of Altamaha spinymussels. In the third case, the Altamaha Riverkeeper won a summary judgment after it disclosed discharges from the City of Cochran's waste treatment pond from July 1995 to August 2000 in excess of the city's NPDES permit. The City of Cochran has been releasing ferric sulfate (used to treat fecal coli form) into Jordan Creek, a tributary of the Ocmulgee River approximately 80 kilometers (50 miles) upstream of known populations of Altamaha spinymussels.

Agricultural sources of contaminants in the Altamaha River basin include nutrient enrichment from poultry farms and livestock feedlots, which occur primarily in the Piedmont portion of the basin, and pesticides and fertilizers from row crop agriculture, which occur primarily in the Coastal Plain portion of the basin (Couch et al. 1996, Frick et al. 1998). Stream ecosystems are negatively impacted when nutrients are added at concentrations that can not be assimilated (Stansbery 1995). The effects of pesticides on mussels may be particularly profound (Fuller 1974, Havlik and Marking 1987, Moulton et al. 1996), and commonly used pesticides have been directly implicated in a North Carolina mussel die-off (Fleming et al. 1995). The Oconee, Ocmulgee, and Ohoopee River systems contain significant acreage in cotton and onion farming. One of the most important pesticides used in cotton farming, malathion, is known to inhibit physiological activities of mussels (Kabeer et al. 1979) that may decrease the ability of mussels to respire and obtain food. Some studies have shown the malathion is slightly toxic to some very

pollution intolerant juvenile mussels (Lampsilis straminea claibornensis) at minimum concentrations of 22,000 ppm. Elliptio icterina had slight problems with minimum concentrations of 30,000 ppm with 96 hour exposure periods.

The Altamaha Park is a marina on the Altamaha River approximately 10 miles (16km) downstream from State Route 301. A number of large houseboats are moored on the river throughout the year and release contaminants, such as fecal coli form, directly into the Altamaha River. The Georgia General Assembly recognized the adverse impacts on water quality that can be caused by recreational boats and recently passed legislation that increased the minimum requirements of boat sanitation systems to include either a holding tank or a U.S. Coast Guard-certified Marine Sanitation Device for all boats. Although this will potentially reduce the quantity of contaminants entering the river, the threat from this contaminant source has not been eliminated, and the Altamaha spinymussel has already been extirpated from this reach of the river (E. Keferl, pers. comm., 2001).

The GDNR Commissioner appointed a Submerged Timber Task Force in October of 1998 to review issues associated with the commercial removal of submerged timber from Georgia waters (GDNR 2003). On March 23, 2005, Senate Bill 283, sponsored by Senators Bulloch and Williams, passed through the Georgia State Legislature, directing the GDNR to create provisions for submerged timber salvage in the mainstem of the Altamaha River and the Flint River. Salvage logging, often called deadhead logging, seeks to recover commercial timber that sank to the bottom of the river. The rafting of commercially harvested logs down Georgia's rivers and streams was a common route for the transportation of timber to coastal markets during the 1800's and early 1900's. Salvagers seek to recover the very valuable old-growth longleaf and cypress which are larger and of superior quality to timber grown in today's market. GDNR (2003) reported that the removal of submerged logs may negatively impact imperiled mussels, including the Altamaha spinymussel and that the effects of deadhead logging need to be researched. Beside the potential direct effect on mussels, the removal of logs could result in changes in river morphology (GDNR 2003).

GDNR has proposed draft policies that will protect the best-known habitat of imperiled aquatic species by placing some river segments off limits to deadhead logging. These prohibited reaches were delimited based upon post-1995 occurrences of the Altamaha spinymussel and the Altamaha arcmussel. Prohibited reaches were also delimited around three high-density mussel beds and known congregation areas for the federally endangered shortnose sturgeon in the lower Altamaha River. As proposed, prohibited reaches account for approximately 14% of the Altamaha River's length (Brett Albanese, pers. comm., 2005). In addition to the prohibited reaches, there will be no logging within the Altamaha River upstream of Doctortown between February 1 and April 31 and downstream of Altamaha River Park between July 1 and September 31 to protect shortnose sturgeon spawning and summering habitat. It should also be noted that the initial law does not authorize any deadhead logging in the Ocmulgee, Ohoopee, or Oconee Rivers or any other tributary streams. No mussel surveys will be required prior to salvage operations in the unrestricted river segments due to the low success rates of previous surveys. Therefore, there could be direct impacts to unknown populations or habitat of the Altamaha

spinymussel. Draft policies will be finalized during Fall 2005 and initial permits for deadhead logging will be issued in Spring 2006. The law is only currently authorized through January of 2008.

B. Over utilization for commercial, recreational, scientific, or educational purposes.
The Altamaha spinymussel is not a commercially valuable species nor are the streams that it inhabits subject to commercial mussel harvesting activities. This species has been actively sought for scientific and private collections. Such activity may increase as the species' rarity increases. Over-collection may have been a localized factor in the decline of this species, particularly in the Ohoopee River where a 1986 collection consisted of at least 30 live individuals (E. Keferl, pers. comm., 2002). The localized distribution and small size of known populations renders them extremely vulnerable to overzealous recreational or scientific collecting. The Altamaha spinymussel is not state protected in Georgia, so there are no regulations to protect it from recreational collecting. However, the Georgia Dept. of Natural Resources can regulate the number of animals collected with a Scientific Collection Permit.

C. Disease or predation.
Diseases of freshwater mussels are poorly known. Juvenile and adult mussels are prey items for some invertebrate predators (particularly as newly metamorphosed juveniles) and parasites (e.g., nematodes, trematodes and mites), and provide prey for a few vertebrate species (otter, raccoon and turtles). Although predation by naturally occurring predators is a normal aspect of the population dynamics of a healthy mussel population, predation may amplify declines in small populations of this species.

D. The inadequacy of existing regulatory mechanisms.
Point source discharges within the range of the Altamaha spinymussel have been reduced since the inception of the Clean Water Act, but this may not provide adequate protection for filter feeding organisms that can be impacted by extremely low levels of contaminants. Several wood processing mills located in the Altamaha River basin discharge effluent directly into the basin's streams. For example, Rayonier's plant in Jessup, Georgia, is permitted to discharge approximately 60 MGD of treated wastewater into the Altamaha River. In addition, municipal wastewater plants continue to discharge large amounts of effluent and, in some circumstances (see section A above), in excess of permitted levels.

Although Best Management Practices for sediment and erosion control are often recommended and/or required by local ordinances for construction projects, compliance, monitoring, and enforcement of these recommendations are often poorly implemented. Furthermore, there are currently no requirements within the scope of Federal environmental laws to specifically consider the Altamaha spinymussel during Federal activities, or to ensure that Federal projects will not jeopardize its continued existence.

The Altamaha spinymussel is not protected by Georgia's Endangered Wildlife Act of 1973. Such designation would protect this species from direct take and would also increase awareness and voluntary efforts to protect this species.

E. Other natural or manmade factors affecting its continued existence.
Non-indigenous species such as the flathead catfish (Pylodictis olivaris) and the Asian clam (Corbicula fluminea) have been introduced to the Altamaha Basin and may be having an adverse effect on the Altamaha spinymussel and other native species. Although the host fish or fishes of the Altamaha spinymussel have not been identified, in other native freshwater mussels, various centrachids, ictalurids, and catostomids have been identified as hosts of the larvae. Since the introduction of the flathead catfish in the Altamaha River, potential centrachid host fish such as the largemouth bass (Micropterus salmoides), redbreast sunfish (Lepomis auritus), and bluegill (L. macrochirus) have all suffered significant population declines (Harrison, pers. comm., 2001). If one of these species is the host for the Altamaha spinymussel, its breeding success and recruitment could be reduced (E. Keferl, pers. comm., 2001; C. Skelton, pers. comm., 2001).

In contrast to the indirect effect of removing the spinymussel's host fish, Asian clams may be a direct threat to native species through competition for available resources (i.e., space, minerals, or food) (Williams et al. 1993). Surveys have found large numbers of Asian clams in the Altamaha Basin for more than 25 years (Gardner et al. 1976; Stringfellow and Gagnon 2001; O'Brien, pers. comm., 2001).

Withdrawal of surface water within the Altamaha Basin for thermoelectric power generation, public water supplies, commercial industrial uses, and agriculture has a dramatic effect on flow rates. For example, Laurens County, Georgia, which includes the City of Dublin, withdrew 2.64 MGD for public water supplies, 12.79 MGD for commercial industrial use, and 5.57 MGD for agricultural uses in 1990 (Marella and Fanning 1990). In general, urban counties withdraw more water than rural counties. In 1990, the total amount of surface water withdrawn from the Altamaha River basin was 1315.88 MGD (Marella and Fanning 1990), and development pressures continue to grow which will lead to increased water withdrawals.

No major dams occur on the Altamaha River system within the known historical range of the Altamaha spinymussel. However, the dams that form Sinclair Reservoir on the Oconee River and Jackson and Tobesofkee Reservoirs in the Ocmulgee River basin can influence mussels and their populations through changes in flows that result from electrical power generation and water storage. Such removals can cause drastic flow reductions and alterations that may strand mussels on sandbars resulting in mortality of individuals and harm to populations. Within the Altamaha River basin, 1149 MGD was withdrawn for thermoelectric power generation in 1990 (Marella and Fanning 1990).

Drought conditions were prevalent in Georgia between 1998 and 2002, which may have negatively affected the Altamaha spinymussel. Georgia averages 127 cm (50 in) of precipitation annually (U.S. Geological Survey 1986) but received less than 102 cm (40 in) of precipitation annually during the recent drought. The Ohoopee River and many other streams in the basin suffered reduced flow rates, and the Ohoopee River was reported to have an estimated average depth of 15 cm (6 in) in the main channel during recent summer surveys (Stringfellow and Gagnon 2001). Normally, mussels will bury themselves in the river bottom as a mechanism to

survive a drought, but many mussels may have desiccated (i.e., died) during this prolonged drought (E. Keferl, pers. comm., 2001). In addition, low flow conditions provide access to the river margins and channels for all-terrain and four-wheel drive vehicles (Stringfellow and Gagnon 2001). These vehicles can directly crush mussels and also destabilize stream banks and increase sedimentation rates. Additionally, the low flow rates provide lower volumes of water to dilute potential contaminants and, therefore, effectively increase the concentrations of contaminants in streams. Federally listed mussels in Spring Creek, which is part of the Flint River basin in southwest Georgia, were severely impacted (e.g., hundreds of mortalities) by drought and low stream flows.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

Although few specific activities aimed at protecting the Altamaha spinymussel have been initiated, the Service works with several organizations, such as TNC, GDNR, and the Altamaha River Keeper, to protect the Altamaha River floodplain and adjacent uplands, which would be beneficial to the Altamaha spinymussel. TNC actively purchases lands within the river basin that exhibit unique biological values and works with landowners to restore and preserve other areas. The Altamaha River Keeper acts as a watchdog group by reporting potential violations of the Clean Water Act to appropriate agencies. Additionally, the Service, through it's Partners for Fish and Wildlife program, has worked with private landowners within the watershed to restore wetlands and adjacent uplands, such as longleaf pine forests. The GDNR has received funds under section 6 of the Endangered Species Act to conduct surveys for the Altamaha spinymussel in the Ocmulgee River and to determine its host fish. Monies have also been awarded to the GDNR to explore the possibility of developing Candidate Conservation Agreements between the State and private landowners to help conserve the imperiled fauna of the Altamaha River.

The Altamaha River Cooperative for Stewardship and Research comprised of representatives from Plum Creek, International Paper, The Nature Conservancy, and the Georgia Dept. of Natural Resources was recently formed with the main objective of identifying critical research and conservation needs in the lower Altamaha Basin with a particular emphasis on relationships between forestry practices and native biological diversity. Other stakeholders including other industrial forestry companies, Georgia Power, paper mills and university researchers have also participated in the Cooperative, but are not formal members. Industry representatives contribute funds to support research and conservation activities in the lower Altamaha Basin. As part of the agreement the Altamaha River Scenic Easement was established, which protects a 91 m (300 ft) wide buffer strip along 45 km (28 mi) of the Altamaha River proper. The easement is comprised of several non-contiguous parcels, most of which occur on one but not both sides of the river. The easement protects over 480 hectares (1200 acres) of river shoreline and floodplain from development, surface mining, and logging activities.

Eleven adult spinymussels were taken into captivity and kept at the Tennessee Aquarium in an attempt to identify host fish species for glochidia. However, two years of work to determine the host species has been unsuccessful. Captive mussels did not become gravid and the work will be discontinued. Eight surviving adults are being returned to the location that they were found.

Understanding the host fish of the Altamaha spinymussel is a critical need for the conservation of this species and this work must be resumed in the future.

SUMMARY OF THREATS (including reasons for addition or removal from candidacy, if appropriate)
The lack of information on the life history of the Altamaha spinymussel and its distribution within a large river draining a large and variously used landscape makes it necessary to consider a wide variety of threats to its continued persistence. Primary among these threats are changes in host-fish communities associated with the introduction of nonnative species, sedimentation from agricultural, forestry, and other land clearing activities, hydrological changes associated with dam operations, water withdrawls, and extreme droughts, and contaminants. A new threat of deadhead logging has recently emerged. Finally, the low abundances and limited distribution of the Altamaha spinymussel make it vulnerable to extinction from demographic stochasticity or a single catastrophic event (e.g., chemical spill).

For species that are being removed from candidate status:
___Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE)?

RECOMMENDED CONSERVATION MEASURES

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	**2***
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude: Because of its distribution in a large river draining a large and intensively used basin, the Altamaha spinymussel faces a multitude of threats to its continued persistence. Threats include changes in host-fish communities associated with the introduction of non-native species, sedimentation from agricultural, forestry, and other land clearing activities, hydrological changes associated with dam operations, water withdrawls, and extreme droughts, and contaminants from municipal, industrial, mining, and non-point sources. A new threat of deadhead logging has recently emerged. The low abundances and limited distribution of the Altamaha spinymussel make it vulnerable to extinction from demographic stochasticity or a single catastrophic event (e.g., chemical spill). Finally, our poor understanding of the Altamaha spinymussels life history characteristics and pollution sensitivity make it difficult to identify specific threats and are a major impediment to conservation efforts. Recent attempts to identify the host-fish of the Altamaha spinymussel were not successful because females were not gravid at the time of collection and did not become gravid after one year in captivity. Efforts to identify potential impacts from heavy metals have not been funded. .

Imminence: The Altamaha spinymussel is imminently threatened with extinction. It has only been observed at 15 sites since 2000, despite extensive survey efforts made by several different researchers. Most of these sites are clustered geographically within short reaches of the lower Ocmulgee River and the Altamaha River upstream of Rt. 301 and there are long reaches with no or sub-detectable numbers of Altamaha spinymussels separating these groups of sites. Recent surveys of the Ohoopee River and the analysis presented by Wisniewski et al. (2004) suggest that the species may still be declining. Finally, the comparitively low numbers of Altamaha spinymussels collected during recent surveys of the Altamaha and Ocmulgee Rivers further suggests that this species has declined from historical levels. To put these results in perspective, researchers in the 1960's were able to find more Altamaha spinymussels at a single site than researchers in the early 2000's were able to document in more than 386 hours of searching (Jason Winiewski, Pers. Comm.).

Rationale for Change in Listing Priority Number: Efforts to identify the host fish and expand our understanding of the Altamaha spinymussels life history have not produced results, attempts to investigate potential impacts caused by heavy metals have not received funding, synthesis of existing and recent data suggests recent declines from surveys conducted in the early 1990s, and a new threat presented by deadhead logging justify changing the Listing Priority Number from a 5 to a 2.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. We have evaluated the current immediacy and magnitude of identified threats to the species in the threats analysis section of this form. At this time, we do not believe the species warrants the need for emergency listing as outlined in Section 4 of the Endangered Species Act. However, we will continue to monitor and assess the status and trends of the species and could adjust this conclusion based on the best scientific and

commercial information available.

DESCRIPTION OF MONITORING: Extensive surveys will continue to document and monitor existing populations. The captive population of 11 adults collected in the summer of 2004 that were being studied to determine host fish species will be returned to the wild. Additional research and management actions need to be taken to further understand the species' life history requirements. The Service and a collection of other interested parties (including GDNR) are working on developing a conservation strategy for the species. Periodic monitoring of the one known population will continue throughout the year in an effort to determine when this species becomes gravid. Once the season that the animals become gravid is determined efforts to identify the host fish will resume. A long term monitoring protocol is also being developed by GDNR at this time.

COORDINATION WITH STATES: The Service has worked closely with the GDNR to asses the status, evaluate the life history and identify potential threats impacting the Altamaha spinymussel. The Altamaha spinymussel is endemic to the Altamaha River which is entirely within the state of Georgia, therefore, no other states have been involved.

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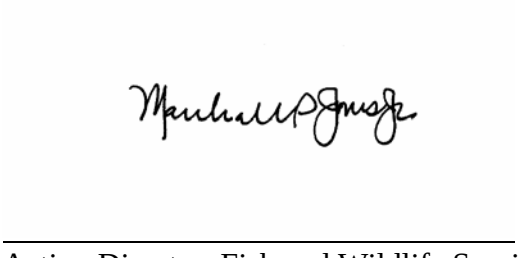
APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: /s/ Jeffrey M. Fleming 11/16/2005
Acting Regional Director, Fish and Wildlife Service Date



Concur: _____ August 23, 2006
Acting Director, Fish and Wildlife Service Date

Do Not Concur: _____ _____
Director, Fish and Wildlife Service Date

Date of annual review: October 2005

Conducted by: Athens, Georgia Field Office